1891–2.

NEW SOUTH WALES.

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# CENSUS AND INDUSTRIAL RETURNS ACT OF 1891.

(INFORMATION RESPECTING.)

Presented to Parliament by Command.

## The Government Statistician to the Honorable the Colonial Secretary.

Government Statistician's Office, , 1892.

HAVE the honor to forward the following report, prepared in accordance with Part II of the Census nd Industrial Returns Act, viz.:—

No. 11: The Coal-mining Industry.

T. A. COGHLAN,
Government Statistician.

# Report No. 11.—The Coal-mining Industry.

## Importance of a Supply of Coal.

The importance to any country of the possession of a practically unlimited supply of coal can scarcely be over-rated. In the present era, owing to the constantly extending application of steam, and the increasing use of gas for various industrial purposes, the demand for coal is becoming larger every day, and this mineral, which at one time was utilised only for domestic purposes, now plays the part of one of the most important factors in the economy of the world. It is admitted that the commercial supremacy of Great Britain is largely due to her valuable fields of coal, and there can be but little doubt that the Colony of New South Wales, which has already benefited greatly by her stores of this useful mineral, has a unique opportunity of still further developing those resources, and of assuming a prominent position among manufacturing nations. The advantages which the Colony may derive from the bountiful supply of mineral fuel which nature has so plentifully provided are too numerous to recapitulate here; but among the more obvious benefits may be mentioned the fact that it would enable various industries to be carried on with profit on the spot that would be handicapped out of existence if a high price had to be paid for the fuel required to generate the necessary motive power. It was not to be expected during the first century of the Colony's existence—its period of childhood, so to speak—that very much could be done in this direction, but it may fairly be anticipated that such a vigorous and enterprising young country will before long be in a position to establish manufactories of iron and other metals, for the production of which a supply of coal is absolutely indispensable. It is scarcely necessary to point out how greatly the economical working of the railway systems of the Colony is promoted by the existence of coal seams, through which the principal traffic highways have to pass; nor is there any need to dwell upon the advantage to the commerce of the sea-ports of New South Wales from the shipping which comes to load with coal—vessels which, probably, would have to leave the shores of Australia in ballast were it not that they can procure cargoes of coal for the use of countries to which nature has denied the possession of so valuable a boon.

## History of the Industry.

Coal is said to have been first discovered in New South Wales, at Port Stephens, in May, 1796, but does not appear to have attracted much attention then. In August, 1797, a vessel called the "Sydney Cove," bound from Bengal to Sydney, was wrecked on Furneaux Island, in Bass's Strait. Mr. Clarke, the supercargo, and 15 men, made an attempt to reach Sydney in the launch, but were driven on shore somewhere to the south of Cape Howe, whence they endeavoured to make their way to the settlement overland along the coast. During the journey, Mr. Clarke states that he fell in with a great quantity of coal, of which he and his companions made a large fire, and slept by it all night. Two days afterwards Clarke and some of his party were rescued by a fishing boat from Sydney, and in consequence of what they reported, Mr. Bass, the intrepid explorer who discovered the strait bearing his name, was sent in a whale-boat to discover where an article so valuable was to be met with. About seven leagues to the south of Point Solander—the South Head of Botany Bay—and therefore in the neighbourhood of the present village of Clifton, he found, in the face of a steep cliff washed by the sea, a stratum of coal, in breadth about 6 feet, and extending about 8 or 9 miles to the southward. Upon the summit of the high land, and lying on the surface, he observed many patches of coal. It is stated by Collins, that "By the specimens of coal brought in by Mr. Bass the quality appeared to be good, but from its almost inaccessible situation no good advantage could ever be expected from it; and indeed were it even less difficult to be procured, unless some small harbour should be near it, it could not be of much utility to the settlement,"—an assertion which subsequent events have altogether falsified.

In September of the same year, or about a month afterwards, a vessel called the "Cumberland," in Port Jackson, was piratically seized and carried off by convicts, and two boats were manned and sent in pursuit. They failed to recapture the vessel, but Lieutenant John Shortland, who had proceeded with one of the boats as far as Port Stephens, on his return discovered and entered a large river, which he named the Hunter, after the then Governor of the Colony. Around the harbour he found a considerable quantity of coal of a very good sort, and lying so near the waterside as to be conveniently shipped. In the course of a year or two it seems to have become customary to send regularly to the Hunter River for supplies of coal, and indeed the river was for some time popularly known as the Coal River. The value of this discovery was not ignored by the pioneers of the Colony, and Collins, in 1799, even looked forward to the time when, by means of the facilities afforded by the vast strata of coal that had been discovered, the iron ore, which the Colony even then was known to possess, could be worked to advantage.

The first exportation of coal from New South Wales is said to have taken place in January, 1800, when forty-five tons of Hunter River coal were exchanged for a quantity of nails and iron, and were taken by Captain Hogan, of the ship "Cornwallis," to the Cape of Good Hope. In the following year a small brig, called the "Anna Josepha," which had been built in the Colony, was freighted with colonial timber and coals, and sent to the Cape of Good Hope, where the cargo found a good market, the coals having realised as much as £6 per ton.

In the year 1826 the Australian Agricultural Company was formed, with a capital of £1,000,000 and a free grant of 1,000,000 acres of land, together with the sole privilege of working the coal-beds in the Hunter River district. The company, however, does not seem to have made the most of their opportunities, for during the period of twenty years through which their monopoly extended, as far as is shown by the somewhat imperfect returns of those early days, their total output was under 330,000 tons, or, on an average, not more than 18,000 tons per year for each of the eighteen years during which their mining operations had been carried on—a total very little in excess of the output of this same company for the year 1891 alone. After the expiration of the A. A. Company's monopoly, other coal-mining companies

panies were formed, and new collieries were opened up, and the output of the Colony, which unted to only 39,000 tons in 1846, had in the year 1851 increased to 67,600 tons; the successive nnial figures being as follows:—

| Year. | Output in tons. |
|---|---|
| 1861 ... ... ... ... ... ... | 342,067 |
| 1871 ... ... ... ... ... ... | 898,794 |
| 1881 ... ... ... ... ... ... | 1,769,597 |
| 1891 ... ... ... ... ... ... | 4,037,929 |

It must be remembered that until some five or six years after the discovery of gold the only mines ked in the Colony were those in the Newcastle district. It was not until the subsidence of the gold r that capital and enterprise were set free to explore in other directions, and attention was directed to coal seams that had long been known to exist in the Southern and Western districts, which thenceforth gradually opened up and worked. Up to the end of 1891 the total output of New South Wales from the commencement of the industry, so far as the records show, was nearly 54 million tons, of estimated value of very nearly £26,000,000. The price of coal has at times been subject to very conrable variation. The lowest recorded price, at the mouth of the pit, was in the year 1849, when it aged only 6s. per ton. The highest was in 1854, when prices generally were inflated in consequence of gold discoveries, and the average value of coal was 20s. 6d. per ton. The average price for the whole ny in the year 1891 was a little over 8s. 7½d. per ton. The coal from the Northern collieries that averaged nearly 9s. 6d. per ton; the Western and South-Western averaged about 7s. 4¾d.; while Southern only brought an average of 4s. 3¼d. per ton.

## The Coal Regions of New South Wales.

The coal-fields of New South Wales are known to cover an area of about 24,000 square miles, of ch it was calculated by the late Mr. Wilkinson, Government Geologist, that the seams which were being ked in 1885 underlay, within a readily accessible depth, 3,328 square miles (nearly half the area of coal-fields of Great Britain), and that they contained, after allowing one-half the total contents as te, the enormous quantity of 14,370 million tons of coal. This estimate did not include the other ns of good coal within the same area not at that time worked, nor did it include the coal in the aining area of over 20,000 square miles of the coal measures in which coal seams are known to exist, which have not yet been proved. It will be seen from these figures that even allowing for a conually progressive increase in the annual output, it must be a very long time before even the seams ded to by Mr. Wilkinson can be worked out.

The coal workings of New South Wales may be conveniently divided into three main divisions:— Northern, or Hunter River districts, comprising the mines in and around Newcastle and along the ey of the Hunter, through Hexham, the Maitlands, Greta, and Singleton; the Southern, including the ieries along the south coast from Mount Kembla, Wollongong, Bulli, Clifton, Helensburg, and ost to the metropolis; the Western and South-Western, which include the mines about Lithgow, rtley, Katoomba, Rylstone, Wallerawang, Moss Vale, and Mittagong. There are also coal-mines ked to a small extent as far west as Dubbo, and the coal measures are known to extend over a very ch larger area than is indicated by the mention of the names above. They have been traced along the thern coast down to Ulladulla, and thence north in a direct line as far as Murrurundi, on the erpool Ranges, extending all the way from the sea coast to the Dividing Range. Further north again, l appears from the Clarence River northwards up to the Queensland boundary. Further inland coal reappears in the Liverpool Plains, stretching northwards thence to the Dumaresq River, which arates this Colony from Queensland. Besides these there are various isolated patches, in one of which Dubbo mines are situated, and of which the extent has not yet been fully gauged.

The seams worked vary from 3 to 25 feet in thickness, most of them are nearly horizontal, or have a slight dip, and none of the shafts are at all deep as compared with those in Great Britain and elsere; many of the mines being worked by drives or adits. In the Newcastle district, with the exception a few mines at Wallsend and Waratah, the collieries are worked by shafts, seldom more than 300 or 400 t deep; the shaft at Greta is 460 feet deep. In the South Coast district almost all the mines are rked by tunnels or drives, the chief exception being the Metropolitan Colliery, at Helensburg, the shaft which is 1,150 feet deep—said to be the deepest sinking on this side of the equator. The head of this ft is in a depression, or small valley, so that the main workings of the mine have fully 1,600 feet above m, almost entirely solid sandstone. In the Western districts shafts are sunk at most of the mines, ugh there are a few collieries worked by means of tunnels.

There is naturally a considerable difference in the quality of the coal obtained in various districts. nerally speaking, the Hunter River coal is more bituminous in its nature than that of the other districts, ich partakes more of the nature of a splint coal. The coal from some of the mines near Newcastle quently fractures into balls or spheres, which, when placed on the fire, become almost liquid, breaking o bubbles, and evolving large quanties of gas. From a series of forty-two proximate analyses of rthern coal, representing every part of the district from Newcastle to Gunnedah and Narrabri, ofessor Liversidge arrives at the following mean proportions:—Water, 2·45 per cent.; volatile hydrorbons, 35·51 per cent.; fixed carbon, 54·29 per cent; ash, 6·80 per cent.; sulphur, 0·88 per cent. e mean specific gravity was 1·3, and the average percentage of coke yielded was 61·14. Of western al, twenty-six samples were analysed, the mean percentages of which were—water, 2·67; volatile hydrbons, 28·99; fixed carbon, 58·13; ash, 9·73; sulphur, 0·73; the specific gravity was 1·35, and the perntage of coke yielded was 67·90. Twenty-seven samples of southern coal, subjected to similar treatnt, gave mean percentages as follows:—Water, 1·55; volatile hydrocarbons, 24·11; fixed carbon, 63·53; h, 10·01; sulphur, 0·76; the specific gravity was 1·35, and the percentage of coke yielded was 73·88. will be observed that the northern coal gives the least, and the southern the largest proportion of ash, hile the quantity of sulphur in each is so small as to be inconsiderable. Professor Liversidge sums up e respective qualities of the various coals in the following terms:—"As a class the northern coals are ghter and more laminated than the southern and western; they yield a larger proportion of volatile hydrocarbons,

hydrocarbons, and are therefore more suitable for making gas, and furnish bright, hard, sonorous coke of extremely good quality. The southern coals are not so bright, and, unlike the northern, they do not coke in an ordinary open fire, but yield a very good coke when treated in ovens. The western coals are of a still drier character and duller appearance; they only coke when freshly raised from the mine."

In addition to the coal properly so called, there are in New South Wales large deposits of the mineral commonly known as kerosene shale, or cannel coal. Strictly speaking, this substance is not a shale, not having any of the characteristic lamellar or platy structure of a shale, but, on the contrary, is very compact, breaking with large, smooth, conchoidal surfaces with equal readiness in any direction, and is generally devoid of all traces of stratification; in fact, it very closely resembles the Boghead coal of Scotland. This substance was described as far back as 1827, by P. Cunningham, Surgeon, R.N., who found it near Bathurst, and was from a very early period utilised by the teamsters along the Great Western Road in the vicinity of Mount York, who found in this mineral a means of providing themselves with a comfortable camp fire, at the slight cost of digging it from the outcrop on the side of the hill, near the road. It is found in very widely-separated localities, such as Colley Creek, Berrima, Broughton Creek, Cambewarra Ranges, Joadja Creek, Meryla, Mount Kembla, Saddleback, near Tenterfield, Blackheath, Hartley, Katoomba, Mount York, Wallerawang, Port Stephens, Capertee, the Nattai River, Narrabri, Lake Macquarie, Greta, Rylstone, Stoney Creek, and other places.

Lignite, or brown coal, is also found in New South Wales. This substance is classed as an imperfect coal, being intermediate in composition between wood and coal; in fact, it may be considered as wood which is gradually passing into the condition of coal. It occurs at Kiandra, where there is a bed 30 feet in thickness; on the Lachlan River, at Dubbo, at the mouth of the Shoalhaven River, at Turalla Creek near Goulburn, and at Chonta, a short distance to the north of Merimbula. Lignite, which would perhaps be considered of some value in countries that are destitute of coal, has not been thought worth the trouble of exploiting in New South Wales, where good coal is so abundant.

## Method of Mining for Coal.

The manner in which the coal is worked, or "won," as it is technically termed, is much the same in each of the various coal-producing districts of the Colony. In any case the workable coal is reached either by driving a tunnel or by sinking a shaft. Main roads are then constructed from the base of the shaft, where sinking has been resorted to, or from some convenient centre if an adit has been driven in. These main roads run in a straight line, and are usually 6 or 8 feet wide, and generally about the same height. As they are made tramways are laid down along them, to convey the coal, as it is won, to the base of the shaft, or to the mouth of the tunnel, as the case may be. At right angles to the main roads excavations are made, generally from 6 to 8 yards in width, and these are known as "bords." An interval of solid coal is left between each bord, of width varying according to the nature of the strata above the coal, but mostly from 10 to 15 yards in width. Subsequently other roads, called "cut-throughs," are made parallel to the main roads, and consequently at right angles to the bords, so that the plan of the workings assumes the form of a series of rectangular roads or throughfares, with blocks of solid coal, called "pillars," between, which are left to support the "roof," or stratum immediately above the coal, so long as the workings are in progress. When the mine gets worked out the pillars are sometimes removed, and the ground is allowed to fall in, and find its own level. In cases where the roof in the roads or bords is likely to give way it is supported by timbers laid across, and held in position by solid upright posts at either extremity. In some mines, where the roof is good, very little of this timbering is required, but in others, where the stratum is friable, the sprags, as they are called, have to be placed with only a short interval between. Occasionally, in order to reach a certain portion of a mine more expeditiously, or for ventilating purposes, "crosscuts" leading from the main roads are put in at any angle, passing through the pillars, bords, or cut-throughs, as the case may be. Tram rails are laid through the principal thoroughfares of the mine, in order that the coal as it is got may be removed to the base of the shaft, or the mouth of the tunnel, without unnecessary delay. Small waggons, called "skips," travel on the tramways, each holding about 12 to 15 cwt. of coal, and propelled either by horse-power or by means of a wire cable.

It is customary for the miners—that is, the men who are employed in actually cutting the coal—to work in pairs, one pair in each bord or heading. In some mines, notably those in the Lithgow Valley, and in some of the Illawarra mines, the coal is remarkably easy to work. The miner commences by lying down on his side, and with his pick cuts underneath the face of the coal he wishes to bring down, prolonging, as it were, the floor of the bord or drive he is working in. He then cuts in a similar manner around the edges of the coal-face, and thus is enabled to bring down in great masses the coal he has undercut. In some of the Lithgow mines every bit of the coal is won by the pick, it being very rarely found necessary to use even a gad or wedge. In point of fact, very little skill is required on the part of the miners in these collieries, but the case is very different as regards the coal-mines of the Northern district. There the coal is much harder to win, and, in addition to the picks, the men have to provide themselves with boring machines or jumpers, and have to call in the aid of gunpowder or dynamite in order to enable them to blast down the coal, and a considerable amount of skill may be exerted in the utilisation and economy of force; in fact, as it will be explained further on, it is quite possible for one pair of miners to win twice as much as another pair can do in similar ground in the same time, who lack the necessary experience.

The coal having been detached from the face is next loaded into the skips, the miners having first taken from it any extraneous matter such as frequently occurs in the shape of narrow bands or strata running through the coal. They are supposed to send out the skips with a certain specified weight of clean coal, and with each skip the miners send out a "token," or piece of tin or leather stamped with a number, indicating the particular pair of miners who have filled the skip in question, in order that they may be credited with the work, for they are paid strictly by results. The skips thus filled are wheeled along the tramway to the base of the shaft or the mouth of the tunnel. In the case of a shaft the skip is wheeled on to the floor of the "cage" or lift, and is hoisted to the top. There are usually two cages running up and down side by side, and as the full skip is drawn up in one, an empty skip is let down in the other. On reaching the top of the shaft or the mouth of the tunnel, the skip is run along the trams to the edge of a platform, where its contents are tilted out upon a "screen," or series of iron bars placed a short distance apart, and sloping downward. The small coal or chips, as it were, produced in the working,

working, falls through the bars of the screen into a truck placed ready to receive it, while the larger masses of marketable coal, roll over into other trucks in which to be taken to the market or port of shipment.

As already stated, the miners are paid only for the amount of coal they actually get. But this does not mean that every separate skipful they send up is weighed; such a process would take too long a time, and involve too much labour. The skips are all the same size in the same mine, and it is known almost to a pound what weight of coal they will contain when fairly and honestly filled; so when the token is taken out of a skip the two miners represented by the number on the token are accredited with the amount of coal the skip is estimated to contain. But in order that a proper check may be kept upon the men the plan is adopted of weighing certain skips selected at random, so that a miner, if tempted to be dishonest, is restrained by the fact that for all he knows the very skip he is filling unfairly may be the one selected for the test, in which case he will have to pay the penalty prescribed by the rules of the mine. It is the same with regard to the "dirt," or extraneous matter sometimes found with the coal. It is impossible to scrutinise every skip, but some of them are selected indiscriminately, and if found to contain more "dirt" than is inevitable and therefore allowed for, the miner has to suffer for his *laches*.

In the case of many of the Illawarra collieries the platforms for weighing and screening the coal are situated at a distance of nearly a mile from the mouth of the tunnel. These are where the seams of coal crop out on the face of the coast range, at the distance of a couple of miles or so from the sea. The land is, as a rule, tolerably level for about a mile from the water, after which it begins to abruptly ascend, until the coal seams are met with at a height of 700 or 800 feet above high-water level. The plan most generally adopted is to construct a tramway on the incline from the mouth of the tunnel down to the comparatively level land near the sea. These inclines follow very nearly the natural contour of that part of the hill which they traverse, having gradients running as high as one in six or seven. The mode of working is as follows:—The skips, when brought out of the adit or tunnel, are run along to the edge of the incline, where they are made up into trains of five or six skips, and are then hooked on to the end of a strong wire cable, wound round a large wooden drum. Being pushed just over the top edge of the incline, the skips, by their own gravity, descend the incline with great velocity. The rope as it unwinds turns the large wooden drum, and this turns a second drum attached to the same axle, and thereby winds up a second wire cable, to the end of which are fastened a number of trucks that have just been emptied at the foot of the incline. The full trucks in their descent, it will thus be seen, pull up the empty ones from the bottom. It will readily be understood that the momentum of the descending full trucks is very much more than is required to cause the empty ones to ascend, consequently there is a considerable amount of power wasted, and it is necessary to apply strong breaks in order to prevent the descending skips from breaking away altogether. In one instance—at the Mount Pleasant mine, near Wollongong—this spare power has been ingeniously utilised; there is a third drum, and a cable which leads into the tunnel and draws out the loaded skips from the interior of the mine, and brings them within a few feet of the top of the incline. The platforms and screens and other arrangements for loading the coal into the railway trucks at the foot of the inclines are precisely similar to those already alluded to. At one colliery in the Illawarra district—the Bulli Pass Coal and Coke Company's mine—the mineral is screened and placed into the railway trucks at the mouth of the tunnel; but there appears to be an objection to this plan, inasmuch as it necessitates heavier works on the tramway and the apparatus connected with its working, and the wear and tear must be extremely great, with greater risk of accident.

At the Katoomba Coal and Shale Company's mine, North Katoomba, there is a very elaborate system of cable tramways. The mine is situated in Jamieson Valley, and the skips are drawn up a very steep incline to the plateau on which the town is situated. There is a double set of rails, one for hauling up the full skips and the other to send down the empty ones, but instead of there being two drums and ropes as in the system previously described, in this case the cable is an endless one, always travelling, and the skips are attached to the cable whenever necessary. A similar cable, though on a less steep incline, conveys the skips to the Company's railway siding, where the coal is put into the ordinary railway trucks ready for transit.

At the Hermitage Colliery, at Lithgow, which is worked by means of an adit, the endless cable system is also in use, with an ingenious arrangement by which the skips grip on to the cable, and detach themselves, when necessary, automatically. The cable, by its own weight, hangs down, and in fact runs along the ground, or rather over rollers placed at intervals between the rails. The drums or blocks around which it travels at either end of the line are, however, raised to the height of several feet above the ground. In the front of each skip is a socket, in which is inserted an upright iron bar, terminating at the top in two points, somewhat resembling the letter Y. When the skip is pushed along the rails under the cable the latter falls into the opening between the two points of the Y, and by its own weight becomes so firmly jammed into the angle as to have a grip that enables it to carry along the skip with its contents of coal. On reaching the other end, the cable is lifted out of the gripper as it rises to pass round the elevated drum, and the skip being thus detached, proceeds for some distance along the rails propelled by the momentum it has already acquired, until it is taken in hand by some of the wheelers who are in waiting, who empty the coal over the screens, and push the skip back along the tramway until it reaches the cable, on which it grips itself, and travels back into the interior of the mine, to be once more filled with coal, and sent out again.

It must be understood that the actual miners form only a portion of the staff employed in and about a mine. The miner simply detaches the coal from the face and places it in the skips. Then the wheelers take charge of the skip, and generally the aid of horse-drivers has to be called in to convey the coal to the place of exit from the mine. In the case of a shaft there are then onsetters, whose duty it is to place the skips properly in the cage. When the skip reaches the surface there are bankers-off, who wheel the skip from the cage to the screens; then there are screen-men, who pass the coals over the screens into the trucks, and there are overmen (or foremen) and deputy-overmen. There are also water-bailers, whose duty it is to remove the water which sometimes accumulates in certain portions of the mine; shiftmen, who prepare the way for the actual miners to work; and general labourers, who are employed both above and below in various kinds of work. Then, of course, there are enginemen and firemen, besides various other mechanics, such as blacksmiths, plate-layers, harness-makers, bricklayers, and carpenters;

carpenters; locomotive engine drivers and firemen in some cases, and frequently stablemen, and a number of boys. In addition to all these there is a mining manager, with some sort of clerical staff. It will thus be apparent that a coal mine in full work finds employment for a large number of men, and for many different kinds of labor.

## Hours of Labor and Remuneration.

In all the collieries throughout New South Wales, and in all departments, the eight-hour system prevails. But it is said that as regards the miners, at all events, the time of actual working is even less than eight hours, for the period is supposed to commence at the time when they assemble at the mouth of the pit, and where there is a large number of men it takes some considerable time for them all to get below, and even when they reach the bottom of the shaft they have in some cases to walk a mile or so through the underground workings before they reach the "face," or surface of solid coal upon which they are engaged. It is reckoned by some of the managers of mines in the Hunter River district that an average of nearly an hour per day might be fairly deducted from the regulation eight as consumed in this way. As the miners are paid, not by time, but according to the quantity of coal they cut, this might seem to be of little consequence; but it should be remembered that until the miners have cut the coal the wheelers, onsetters, bankers-off, screenmen, and others have nothing to do, and these are men who are paid a daily wage.

It happens sometimes that orders are plentiful, and ships waiting to take the coal away in larger quantities than can be got during the eight hours of labour, and in such a case extra "shifts," or sets of men, are put on to work for another eight hours when the regular hands knock off. In some instances it has been found necessary to work in three shifts, so that the mine has been working continuously day and night. In opening up new workings, or when what is known as a "fault" occurs, the shiftmen, who have to prepare the way for the miners, are frequently kept working in two or three shifts, and the same thing occurs in the event of an irruption of water into the mine. But in all cases it is a different set of men that are taken on to work in the second or third shift, and none work more than eight hours.

The amount of remuneration paid to the miners for getting the coal varies according to the district. The coal being easier got in the Southern and Western districts, the hewing rate there is less than in the Northern collieries. In each district there has been agreed upon a certain price as the district standard rate, which is that usually paid, subject, however, to modification according to certain varying conditions, but evidently arranged with a view to enable the miner, under all circumstances, to earn at least 9s. to 10s. per day. In the Southern and Western districts, at the present time, 2s. 4d. per ton is the district hewing rate; in the Northern collieries 3s. 10d. has been paid since the beginning of this year, 4s. 2d having been the rate previously. It has been made a matter of agreement between the colliery proprietors and the miners in the Northern district that the hewing rate shall depend, to some extent, upon the price realised for the coal. If coal cold at 12s. per ton, the hewing rate was to be 4s. 6d.; if at 11s., then 4s. 2d. was to be paid; if at 10s., the rate was to be 3s. 10d.; if 9s., then 3s. 6d. was to be paid, but however low the price fell below 9s., the hewing rate was not to be lowered under 3s. 6d., which was settled as the absolute minimum. No limit was fixed, on the other hand, but however much coal went up in price, the miner was to receive an additional 4d. per ton for every 1s. per ton that the coal rose in price. For a considerable time the selling price of coal stood at 11s. per ton, and the miners received 4s. 2d. for hewing; but at the beginning of the present year the colliery proprietors thought it necessary to reduce the price to 10s. per ton, and, in consequence, the hewing rate was lowered to 3s. 10d. This rate obtains all throughout the Northern collieries, with the exception of that at Stockton, where, having large contracts on hand to supply coal to Victoria, the company did not think it necessary to make any change, and still continue to pay the old rate of 4s. 2d. per ton. But there are three other elements which have to be taken into consideration in determining the amount to be paid to the miner—these are, the thickness of the seam, the width of the drives, and the amount of dirt or extraneous matter in the coal. Five feet is held to be the standard thickness of a seam of coal, and should it run less than the standard, an allowance has to be made to the miner for every inch of such deficiency. Again, the width of the drive is an important factor, so far as the miner is concerned. It is very little more trouble to him to undercut a wide face than a narrow one; but he brings down a much larger amount of coal from the wider surface with much about the same amount of labour. It has therefore been agreed that the standard width of the bords shall be 8 yards; and in all drives of a lesser width the miner is paid an allowance per lineal yard, in proportion to the deficient width, in addition to the hewing rate. Then, again, with regard to the "dirt." If the bands or extraneous matter do not exceed 6 inches in the standard thickness of 5 feet, the miner is expected to remove that amount of dirt without extra payment; but where there is more than 6 inches of dirt he is entitled to compensation in proportion to the thickness of the band.

The small coal, or "slack," as it is termed, consists of the chips or small particles of coal unavoidably produced in undercutting and in detaching the coal from the seam. Until quite a recent period, the slack was literally a waste product, and around most of the older colleries large and gradually increasing heaps of it might be seen. It was in many places thrown down along the company's railway lines instead of ballast; and in some of the mines it was used to block up abandoned workings, where it was necessary to turn the ventilation in another direction. The slack was supposed to be the property of the company, and the miners were paid nothing whatever for getting it; but during the great strikes which occurred a few years ago, when coal of all descriptions had become scarce, it was found that the hitherto despised small coal could be made of value, and a demand arose for it for various purposes. It is used by blacksmiths, and for stationary engines, and in some cases it is utilised for making coke. Since a market has been found for this product a small allowance has been made to the miners for getting it, at rates varying in the different collieries from 4d. to 9d. a skip. The skips, when filled with slack, contain from half a ton to 12 cwt., as a rule. A custom obtains almost universally in the collieries of allowing each miner to take as much coal as he may require for the consumption of his family; and it is understood that this concession is in some respects a recompense for the small coal he produces. It is quite a common thing to see a miner returning from his work carrying with him a lump of coal, or a bag full of it, weighing 1 cwt. or more.

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In one of the principal collieries in the Newcastle district the miners engaged in cutting the headings, or main roads, which are from 6 feet to 8 feet wide, receive 8s. 8d. to 9s. 4d. per lineal yard, in addition to the ordinary hewing rate for the coal. In the case of cross-cuts, which are of the same width as the headings, the extra rate is about 9s. 6d. to 10s. 2d. per yard, it being considered more difficult to cut the coal on the bias, as it were. Where the bords are only 5 yards in width the miners receive an addition of 5s. 6d. per lineal yard over and above the regular hewing rate. Similar rates obtain all through the district.

In estimating the actual earnings of the miners it must be remembered that they have to provide themselves with tools, and where blasting is necessary they have to find their own powder and fuse. The expense incurred on this latter account is estimated at from 1s. 3d. to 1s. 6d. per miner per week in the Hunter River district, when working full time. Of course when work is slack less powder and fuse will be consumed

As regards the quantity of coal which a pair of miners can win in a day, that very much depends upon circumstances. The practical skill of the men themselves must first be taken into consideration, for it is often the case that in the same ground, and under precisely the same circumstances, one pair of miners, having the necessary skill and experience, will win twice as much coal as another pair who do not know how to properly utilise their energies. A great deal also depends upon the nature of the ground being worked, for there is an enormous difference in the ease with which the coal may be got in one spot as compared with another, not only as regards different mines, but even in the same workings. So thoroughly is this fact established that it has become the custom, in order that there shall be no favouritism shown to any particular men, to draw lots to determine the places at which the men shall work. This operation, termed "cavilling," takes place at the commencement of every quarter. The management having decided in which direction the workings are to be carried on during the next three months, the miners draw lots, and whatever station they get thus assigned to them they retain until the next "cavil." This system is considered fair to all alike, and it may happen that a pair of men get an excellent bit of ground one quarter, and a piece that is very hard to work in the next.

It is estimated that in the Hunter River collieries 2½ tons per miner per day would be a fair all round average, that is 5 tons for each pair of miners in eight hours. This, at the present hewing rate of 3s. 10d. per ton, would mean an average wage of 9s. 7d. per man per day, from which, however, the cost of powder and fuse would have to be deducted, leaving the net earnings at about 9s. 3d. to 9s. 4d. each. Up to the end of 1891, when the hewing rate was 4s. 2d. per ton, the miners' average wage would have been about 10d. in excess of the figures just given, that amount being about the average loss to the miners through the reduction. But it must be observed that the mine-owners, in agreeing to sell the coal at 1s. per ton less than the price of last year, themselves submitted to two-thirds of the loss, or 8d. in the shilling, while the miners contribute the other 4d.; the other hands about the mines not being affected in any way by the reduction. It must not be understood, however, that the Newcastle miners earn an income anything at all equivalent to 9s. 4d. per day, that is merely the average wage they earn on those days when they work, while the fact is that, with the exception of some two or three of the collieries, the work is anything but constant. It is the custom among workers in coal to be paid every fortnight, and almost without exception, every alternate Saturday, or pay day, is kept as a holiday. This leaves only eleven work-days in the fortnight when the mine is on full time, but unfortunately, for a long while past, full time has been the exception, and not the rule. Not more than three or four of the Newcastle collieries have worked full time during the present year, and taking the district through, it is estimated that not much more than six or seven days per fortnight have been worked, and that, therefore, the miners have not earned more than about 33s. per week all round, at the very outside. When it is remembered that in some cases miners have earned as much as £5 per week, it will readily be understood that others must have received as little as 20s. for their weekly wage.

In the Western and Southern coal districts, although the hewing rate is less, the miners earn about the same money as those in the north, as the coal is so much more easy to get, and they are not at the same expense for blasting. In these collieries there is, as in the north, a scale of extra charges for working in narrow headings, or on seams of coal less than the standard thickness. But in these districts, as in the north, the men complain of too much enforced idleness, and, in fact, the mines do not work more than two-thirds of full time, taking them all round. The average earnings in the Southern mines are, as ascertained from the pay-sheets of the present year, from 9s. to 10s. per man for every day worked; in the Western district the average would be from 9s. 6d. to 10s. 6d.; so it will be seen that while the miners are doing fairly well where the work is pretty constant, they must find it hard to make a living where things are slack.

There are a few collieries where more than the ordinary district rate is paid for hewing. For instance, at the Mount Kembla mine, during the early part of the year, by a special agreement, 2s. 5d. per ton was paid, and where the seam narrowed down to 3½ feet as much as 3s. 6d. per ton was paid. Again, at the Metropolitan mine, Helensburg, which is considered to be a "gassy" mine, it is found necessary to work with safety-lamps, instead of the ordinary naked lights. The safety-lamps do not give quite so bright a light as the common tallow flare, and the miners consequently insist upon a payment of 3d. per ton extra for hewing the coal. Another instance of a higher price than the district rate being paid is at the Bulli Pass Coal and Coke Co.'s Colliery, where 3s. per ton is paid for hewing. But this is under peculiar circumstances. The seam is 6 feet in thickness; but, while the top 3 feet consists of coal of excellent quality, the lower half consists of natural coke, formed evidently by the intrusion of igneous matter beneath the coal, long after the latter had been formed, which has had the effect of completely coking the lower portion of the seam. Large quantities of this natural coke are used in working the Sydney tramways, and it is said to be well adapted for the purpose.

One circumstance affecting considerably the earnings of some of the miners has yet to be taken into consideration, and that is the system of working the skips. This is a matter, however, for which the colliery proprietors are in no way responsible, for it is a regulation made and strictly enforced by the union. This regulation fixes the maximum number of skips that shall be supplied to each pair of miners per day. If, for instance, a wheeler has to supply three pairs of miners, one pair being able to fill ten skips in the day, and the other two eight and six skips respectively; in this case an average will be taken and eight skips will be the maximum number allowed to any pair, with the result that the two men who are ready and willing to fill ten skips are not allowed to fill more than eight, although there may be

working

working near them a pair of men who are unable to fill two of the skips they are entitled to. An alteration in this respect seems to be much desired by the more expert among the miners.

The wages paid to the other hands employed in and about a colliery are very much about the same in all the various districts of the Colony. The following table shows about a fair average:—

| | Per diem. | | | | | | Per diem. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | s. | d. | | s. | d. | | s. | d. | | s. | d. |
| Loco. engine-drivers | 10 | 0 | to | 12 | 0 | Bankers-off | 7 | 6 | to | 8 | 6 |
| „ stokers | 7 | 0 | „ | 8 | 0 | Wheelers | 4 | 0 | „ | 7 | 6 |
| Engine-drivers | 9 | 0 | „ | 15 | 0 | Horse-drivers | 3 | 4 | „ | 7 | 6 |
| Firemen | 7 | 0 | „ | 8 | 0 | Flatters | 4 | 6 | „ | 8 | 6 |
| Overmen (below) | 10 | 0 | „ | 14 | 0 | Trappers | 2 | 0 | „ | 3 | 0 |
| „ (above) | 11 | 6 | „ | 13 | 0 | Furnace-men | 6 | 6 | „ | 7 | 6 |
| Deputy Overmen | 9 | 0 | „ | 11 | 0 | Stable-men | 7 | 0 | „ | 7 | 6 |
| Screen Overmen | 9 | 6 | „ | 10 | 0 | Harness makers | 7 | 6 | „ | 8 | 0 |
| Screen-men | 6 | 6 | „ | 7 | 0 | Water-bailers | 6 | 6 | „ | 7 | 6 |
| Shift-men | 7 | 0 | „ | 10 | 0 | „ (boys) | 3 | 0 | „ | 3 | 6 |
| Platelayers | 8 | 6 | „ | 10 | 0 | Labourers (below) | 6 | 0 | „ | 7 | 6 |
| Blacksmiths | 8 | 6 | „ | 10 | 0 | „ (above) | 6 | 0 | „ | 7 | 6 |
| Mechanics | 9 | 3 | „ | 10 | 6 | Boys | 2 | 6 | „ | 3 | 0 |
| Onsetters | 6 | 6 | „ | 10 | 0 | | | | | | |

These wages would be fairly good if the work were constant all the year round, but as most of those enumerated above only work when the miners work, their aggregate receipts are effected in the same way, and are subject to the same reduction. Some of the men, such as the engineers and stablemen, have to be employed constantly, and are paid for each day in the week, but in the majority of cases an idle day in the mine simply means the loss of a day's pay.

In connection with the question of remuneration, it may be stated that there is in existence in some instances what is known as the tribute system, which is represented by some of the miners to be somewhat in the nature of sweating. Under this system a small party of miners join together and lease a portion of the mine from the proprietors, paying them a certain royalty on all the coal they put out. The tributers, it is said, employ other men as day labourers, who have to do more work than is usually considered a fair thing. The tribute system, however, although formerly rather prevalent, at present only exists in a very few instances, and, it is stated, chiefly in small collieries where the union rules are not strictly enforced, and the evils, whatever they are, arising from this system, are very limited. On the whole, it may be safely stated that the miners, and in fact all who work in the collieries, are fairly satisfied with the rate of remuneration; but their complaint is that the work is not sufficiently constant. It is very doubtful whether the majority would prefer actual full work—that is, eleven days to the fortnight. Judging by the large percentage of absences in some of the instances where the mine is worked for that number of days, and from the statements of the miners themselves, it would seem that the men generally consider that the could live comfortably if they worked five days a week, and that that amount of labour would be as much as they could fairly be called upon to sustain.

### Method of Instruction.

There is no regular system of apprenticeship among the miners, but a method of gradual advancement obtains pretty generally in all the coal districts of the Colony. Boys are usually taken on to work at about the age of 14 years, and their first employment is perhaps that of a trapper. The trapper is in charge of one of the traps or doors which are used in ventilating the mine, and it is his duty to open the door when any skips or miners come along, and then to carefully close the door, so that the air shall not be allowed to waste itself where it is not required, but shall be forced along into the galleries where the men are at work. The duty is, perhaps not very arduous, but it trains the lad to habits of care. After working a year or two as a trapper the youth, if found reliable, is promoted to be a driver or wheeler, at a gradually increasing rate of wages. Under ordinary circumstances, he will not be put on to the face of the coal—that is, he will not become an actual miner—until he is about 18 years of age, when he will be taken on as "mate" by his father or some other relative or friend. Of course, a new hand is not worth so much as an old experienced one, and the neophyte cannot expect to earn high wages at first. The proprietors pay each set of two men for the coal put out by them jointly, and where they are both experienced men they simply divide the money between them. But when a young man joins an old man for the purpose of being taught his trade, it is agreed between them that the elder shall for a time receive the larger proportion of the earnings. By far the majority of miners have commenced in this way, but there are instances where a man who has been used to the pick at other work is taken on as a mate by a practised miner, and in this case also a deduction from the pay of the stranger is made to the miner as a premium for teaching him the business. The onsetters, bankers-off, screen-men, and others about the mine are recruited from among those boys who do not care to go on the coal; but the mechanics are mostly engaged from outside. The shiftmen, in many cases, are miners, who prefer the more regular employment they get as shiftmen to the nominally higher wages earned by the miners. A young man of fair education and intelligence may look forward to the position of overman or foreman, with a considerable advance of salary, and indeed, may possibly attain the position of manager of the mine, for a large number of the gentlemen who now fill those posts commenced work in the mines as trappers, and have gradually raised themselves through their industry and intelligence. The miners themselves are, generally speaking, in favour of the present system of advancement, and consider that a certain period of probation should be compulsory before a man is allowed to go on to the coal. They point out that a man without proper experience is liable to injure himself as well as his mate, and perhaps, in addition, may place in jeopardy the lives and limbs of other miners who are working in the neighbourhood. As a matter of proper precaution then, they argue that some preliminary training should be insisted upon, and that a provision to that effect should be inserted in the Mining Act.

### Mode of Living and Habits of Miners.

The land taken up for mining purposes by the colliery companies, whether leasehold or freehold, is generally of considerable extent, and as the working miners, as a rule, prefer to reside in the vicinity of their work, in very many cases they are allowed to utilise portions of the surface not required for mining purposes by residing thereon. The custom in this respect varies very much in different places. Most of the municipalities around Newcastle are simply mining communities—that is, the great bulk of the inhabitants

itants are employed in one capacity or other in or about the mines, and the remainder consists of radespeople who make it their business to supply the miners' wants. In these townships the es, or rather cottages, are seldom more than one story high. The majority, perhaps, are built of , but there is a fair proportion constructed of stone or brick. They seem mostly built after the plan, consisting of two or four rooms, with a detached kitchen, the roofs being almost universally rrugated galvanized iron. The custom prevails very extensively of painting the exterior of these ings with coal-tar, which is no doubt an excellent way of keeping out the damp, though giving a reness to the scene hardly grateful to an artistic eye. Very many of these cottages are the property e residents, acquired, or in process of acquisition, through the medium of a building society. In many cases the habitations are built by the proprietors themselves, and it is not at all an uncommon to see a miner, after he has left the pit in the afternoon, without waiting to wash the coal off his engaged in building a wall or chimney, or constructing a verandah, or making a fence, or otherwise ged in erecting or improving his house. Sometimes you may see him hurrying to his home on a y bicycle, with his lamp still attached to his cap. There is one circumstance that strikes a visitor to mining boroughs, and that is the paucity of gardens attached to the dwellings of the miners. e are, of course, some exceptions; in fact, in a few places there are little gardens with flowers and tables that do credit to the taste and industry of the inhabitants. These are, however, the exception, n the majority of instances the mining community seems to prefer leaving the land in a state of re, and inclines rather towards poultry and goats than to flowers and vegetables.

As regards the interiors, they are usually furnished with a considerable regard to comfort, and the n doors in fine weather disclose sitting-rooms, often with a carpet or rug upon the floor, and good l tables, chairs, sofas, and other articles of furniture, with pictures, bright in colour if not altogether stic, upon the walls, and snow-white curtains and tidies about the room, bearing evidence to the nliness and taste of the housewife. The children, as a rule, will be found fairly well dressed, with exception that shoes and stockings are evidently not regarded as absolute necessities during the warm ther, at all events. But when seen in the early morning, on their way to school—and excellent lic Schools are provided in all the mining centres—the little folk will be found to be clean and pectable in appearance. The miners themselves, and their wives, manage to turn out a very sentable appearance on Sundays and pay Saturdays, showing that they take a proper pride in nselves, although it is evident from the limited amount of the earnings of late, that no small amount management must have been exerted in order to do so.

In many of the coal districts, where the miners live upon the land belonging to the company, they ld their own houses, and pay a nominal ground rent for the use of the land. In most cases the llings erected under these circumstances are rougher in appearance than those in the mining nships where the occupier is also the freeholder. This is notably the case at Minmi, where there is municipality, the whole of the site of the township being the property of the proprietors of the mine, the streets are ill-formed, and there is a perceptible absence of the sanitary conveniences that are erally among the first objects of the care of a municipal body. At Greta, which is about thirty-two miles m Newcastle, all the men live in the municipality, and none on the company's land. It is estimated that ly one-third of them own the property upon which they reside. In the Western coal districts it is st common for the miners to live in their own houses, paying a small ground rent for the land they upy. In the locality of some of the Southern mines, however, the colliery proprietors build houses the men to occupy, for which a rent of from 2s. 6d. to 5s. per week is charged. In the case of the tropolitan mine, at Helensburg, the cottages erected by the company for the use of the miners are idedly superior; but they are not much sought after by the men, as the company insists upon certain itary regulations being rigidly observed, while very many of the miners prefer to enjoy the freedom being dirty if they please.

Taking the coal-miners of the Colony as a class, they will certainly compare favourably with any er body of workmen. The prejudice against the miners that they are a rough, ill-conditioned lot, rdinately addicted to drink, if ever it were true, certainly is not so now. Anyone who travels the mining districts and mixes with the men will find them civil, obliging, and intelligent. In ne matters, perhaps, their judgment is somewhat warped by class prejudices, and they may be her too apt to look upon the capitalists as their enemies, but these prejudices do not appear to be strong as they formerly were, and are evidently fading away before the light of reason and truth. iners, as a rule, are great readers; there are few of them who do not take some newspaper regularly, and y are staunch supporters of the schools of arts and mechanics' institutes which abound. As for the ittony and intoxication sometimes attributed to them, there may have been isolated cases—probably t more than found in other laborious handicrafts—but it is only necessary to look at the small amount wages earned by these men for a long time past, and it will at once be seen that only by the exercise great thrift, foresight, and sobriety has it been possible for them to live at all. That they and their ildren and their homes are kept in so creditable a condition under the circumstances speaks volumes r their prudence and self-restraint.

## Effect of Mining with regard to Life and Health.

Very diverse opinions seem to prevail with regard to the effect of the occupation of coal-mining upon e life and health of those engaged in it. By the men it is urged that the calling is one full of peril. ot only, they say, are they subject to accidents that cannot be forseen from the nature of the ground, hich often appears perfectly safe, when in reality it is ready to fall and entomb the unhappy miner at a oment's notice; not only are they subject to this risk, but they are always working under abnormal nditions—in the bowels of the earth, away from the light of the sun, obliged to adopt unnatural sitions while at work, and subject to all the ill effects of bad ventilation and vitiated air. On the other and, the proprietors assert that the risks incidental to the employment are not greater than are met with many other callings, and that the fact of men working in the collieries often up to and over the age of 0 years shows that there is nothing particularily unhealthy about it. The truth will probably be found omewhere between the two extremes.

With regard to the risk of accident, it is recorded that in the year 1891 there were 20 fatal and 4 non-fatal accidents in the coal mines of New South Wales. As there were 10,820 men employed in and

and about the mines of the Colony during that year this would give an average of 1·85 fatal and 5 non-fatal accidents to every 1,000 men employed. The average of fatal accidents in the coal mines of England for 1890 was within a trifle of the same rate, showing that the occupation in the Colony is not necessarily more dangerous to life than it is in England, though the proportion of fatal accidents to those employed is beyond question greater than is the case in many other occupations. There are no means available to show the proportion of fatal accidents to the number of persons engaged in any other calling, but the census population of 1891 was 1,132,234, and the number of fatal accidents throughout the whole community during that year was 943, or at the rate of ·83 per thousand, or less than half the rate that prevails among the coal-miners. Many of the accidents no doubt arise from carelessness and over confidence on the part of the miners; but, on the other hand, even the most experienced and careful men are sometimes deceived by the appearance of the ground, which, although apparently perfectly sound, may be in reality very dangerous and ready to fall.

As to the question of ventilation, the mine-owners declare that the men have nothing to complain of. They are bound by the Mining Act to supply a certain quantity of air per minute to every man and animal in the workings. There is a Government Inspector who periodically inspects the mine, and ascertains by the revolutions of the anemometer the exact quantity of air passing through the various portions of the mine, and if the minimum quantity prescribed by the Mining Act—100 cubic feet of air per minute for every man, boy, and horse employed underground—is not supplied, the manager is summoned to the Police Court, and is liable to be fined. As a further protection to the men they are allowed to provide for themselves a system of check inspection. Two of their own number are appointed to make an independent inspection of the state of the ventilation in the mines every fortnight, the results of which are recorded in a book kept for that purpose. These check inspections are made punctually in most of the Hunter River collieries, but are not carried out regularly in many of those in the Western and Southern districts, where apparently the ventilation is perfectly satisfactory. The check inspection as carried out in some of the Northern mines does not appear to be of much value, as the men told off for that duty are not always well skilled in the use of the thermometer and anemometer, so that the observations they make with those instruments are not altogether reliable, though they can tell pretty well by their sensations whether the air is fresh or not.

It is chiefly in those mines where it is necessary to blast the coal that complaints are made of bad ventilation, and it is easy to understand that the fumes of powder would be very unpleasant to breathe, as well as unwholesome. The Mining Act provides that every mine shall be divided into districts, or "splits," of not more than seventy men, and that each district shall be supplied with a separate current of air; also that there shall be no workings at a greater distance than 35 yards from the passage traversed by the current of air. The effect of this provision is, that when bords are driven from the main roads they must not be taken more than 35 yards before cut-throughs are made, which, as before explained, run parallel with the main roads, and from which continuations of the bords are made for a distance of another 35 yards, when fresh cut-throughs have to be made. It may be asked how is it that the air is made to traverse these rectangular openings, and it is not very easy to make a clear explanation without the aid of diagrams. Of course, it is necessary to create a draught, and this is usually done by means of a shaft, called the "up-cast." Sometimes a roaring fire is kept up at the base of the up-cast shaft, which makes a draught so strong as to suck up all the air around, and so cause a current to rush towards it from all parts of the mine with which it is in communication. In other places there is a fan in the up-cast shaft, which, revolving at a high rate of speed by means of steam, sucks up the air, as in the other case. The air thus withdrawn is supplied by the in-current of fresh air, which rushes down the main shaft or through the entrance of the tunnel, as the case may be. The in-taken air naturally makes its way as directly as possible towards the up-cast shaft, and would thus ventilate only the passage between the point of entrance and that of egress were it not artificially directed towards whatever portions of the mine the men are working in. This is effected by stopping up such of the openings as may be necessary, either by filling them up with small coal and *debris* or by erecting traps or doors. In this way the air may be made to circulate around the whole of a split before reaching the up-cast, or exit. This is where one of the great complaints of the miners comes in. They point out that the men working in the bord nearest the in-take are supplied with pure air, but their powder-smoke and other impurities are swept into the next bord, where they mingle with the vapours already there, so that the air gradually gets more and more charged with deleterious matter, and in fact becomes perfectly foul before it reaches the end of the split, to the detriment of the unfortunate miners who are located at that part of the mine. They further complain that although the stipulated quantity of air may pass along the air-way, as prescribed by the Act, yet, when the bords get to be a considerable depth, the air does not enter the bords to benefit the men who are working at the extreme end of them, and they are compelled frequently to leave the face of the coal and go to the heading in order to breathe. The remedy suggested for this is the adoption of a system of "bratticing." A "brattice," it should be explained, is a temporary screen, made of wood or cloth—generally the latter. A brattice placed right across the heading, and extending some distance along the middle of the bord, would have the effect of diverting the air-current right into the bord on one side of the brattice, while it would return along the other side, and so re-enter the heading to continue its course. There can be no doubt that the adoption of such a system would tend very greatly to clear the foul air out of the bords; and if a constant current were kept up in this way it would relieve the miners of much that they now complain of. But the Act does not stipulate that such a system should be adopted, and it would unquestionably entail a very large additional expense upon the proprietors, and would therefore greatly increase the cost of getting the coal. Brattice-cloth consists of canvas covered with tar, and would cost fully 2s. per yard, and a great many yards would be required to make a brattice of any size, as the width of the canvas is only about 24 inches. Where canvas brattices are used the cloth is left hanging loose along the headings, so that the skips can travel along the tram-rails without obstruction. But if wooden brattices were used it would be necessary to have doors or traps, and these would require boys to attend to them, thereby again adding to the cost of working the mine, to say nothing of the expense of removing and re-erecting the brattices from time to time as the work progressed. It should be observed that these complaints of bad ventilation all came from the Northern mines, where the system of blasting has to be resorted to, while in the Southern and Western mines the men made little or no complaints on this score.

While on the subject of ventilation in coal mines, it may be mentioned that some of the miners express a very poor opinion of the efficacy of the present system of inspection. They say that the manager, knowing when to expect the Inspector's visit, and being anxious that his mine shall be as favorably reported upon as possible, takes good care that every thing shall be in perfect order on that occasion, whatever might be the case at other times. Some of them even go so far as to say that the officials occasionally shut off the air entirely from all parts of the mine except the district which the Inspector is at that moment examining, which, under those circumstances, receives for the time being a far greater quantity of air than the Act requires. When the Inspector leaves that particular district and enters another, the air is cut off from the one just inspected, and the whole air force is put into the one next to be examined, and so on with each split or district. In this ingenious way, it is said, the Inspector is made to find a superabundance of fresh air in every part of the mine, although under ordinary circumstances the supply may be deficient all through. Whether such tricks are actually played upon the Inspectors has not been shown, but there is a strong impression in the minds of some of the miners that something of the kind is not altogether unknown.

It is worthy of notice that in the Bulli mine, where the terrible explosion occurred on 23rd March, 1887, by which no less than eighty-one lives were lost, the ventilation is now so good that the miners work with naked lights. The most gassy mine in the Colony at the present time is the Metropolitan, at Helensburg, where it is not considered safe to use any but locked safety-lamps though the ventilation is far in excess of the requirements of the Act, a ventilating fan being used which is said to be one of the largest in the world. This mine has been rather unfortunate with regard to accidents, owing to the treacherous nature of the ground; most of those recorded during the past year consisted of injuries to, and fractures of, limbs, owing to falls of coal. At this mine the management have taken the precaution to have an ambulance stretcher always ready, together with a supply of bandages and other necessary appliances for first aid in the event of an accident.

There are two diseases which are said to be peculiar to miners. One is an affection of the chest, known as "Miners' Asthma," and is attributed to the impurity of the air sometimes breathed by the men when at work, aided probably by the fine coal dust which cannot fail to be inhaled occasionally in considerable quantities. The other ailment incidental to the calling is an affection of the eyes, resulting in a sort of astygmatism, which is thought to be owing to the fact of working in partial darkness, illuminated only by a light which falls at an unnatural angle upon the optic nerve of the miner, especially when he is lying down in order to undercut the coal.

## Condition and Prospects of the Industry.

That the condition of the coal-mining industry at the present time is not altogether satisfactory is sufficiently demonstrated by the fact that several of the mines are altogether idle, while many others are working only a few days in the week. The causes of this unsatisfactory state of things are various, but the principal one is obvious even to a cursory glance. When it is remembered that the output for the year 1891, 4,037,929 tons, was the largest ever known in a single year during the history of the Colony, notwithstanding the fact that few of the mines were working full time, the inference that there are too many collieries can scarcely be resisted. That this is the case is admitted by proprietors and miners alike in all parts of the Colony; indeed it is estimated that without opening up one additional seam of coal there is enough in view at the present time to enable 10,000,000 tons to be put out annually for some years to come. It is apparent, therefore, that, although the demand for New South Wales coal has increased, the means for supplying that demand have increased in a still greater ratio. At the same time it is equally certain that there are too many coal-miners in the Colony, since even the increased rate of production during 1891 could not find anything like full work for them all. There can be no doubt that it would require a large expansion of the coal trade before all the mines in the Colony could be worked, and all the miners profitably employed.

As already stated, the output of 1891 exceeded that of any previous year; compared with that of 1890 it showed an advance of 997,053 tons as regards quantity, and an excess of £463,707 in value. It is asserted by some of the owners that although there has certainly been an expansion of trade in some directions, in others there has been a falling off—in fact, a total loss of some branches of the trade that might and ought to have been preseved to the Colony. They say that the disastrous strikes that occurred a few years ago had the effect of disgusting ship-owners with New South Wales ports, and not only made them chary of sending their vessels where they might find themselves compelled to wait for months before they could get a cargo, but caused them to seek for other places where they could procure coal, which, if not so good as that of New South Wales, pays the ship-owners better, because they are sure of being able to load their ships without disastrous delay. This was the reason, they contend, why the coal-mines in Japan and China were opened up, which are now said to be the chief sources of supply for many of the eastern ports which used previously to depend upon Newcastle and Sydney. It may be worth while to notice the alterations there have been in the export of coal from New South Wales for the last few years to some of the principal eastern ports, as shown below:—

Export of Coal to Eastern Ports.

| Port or Country. | 1888. | 1889. | 1890. | 1891. |
|---|---|---|---|---|
| | Tons. | Tons. | Tons. | Tons. |
| Hong Kong ... ... ... ... | 48,061 | 102,702 | 53,370 | 59,227 |
| India ... ... ... ... ... | 36,143 | 67,266 | 31,172 | 21,690 |
| Java ... ... ... ... | 35,653 | 86,057 | 35,531 | 43,689 |
| Philippine Islands ... ... ... | 34,000 | 59,426 | 29,543 | 53,309 |
| Singapore ... ... ... ... | 21,568 | 66,580 | 51,660 | 89,183 |
| China ... ... ... ... ... | 10,656 | 19,505 | 1,031 | 17,900 |
| Mauritius ... ... ... ... | 7,323 | 15,497 | 7,238 | 19,760 |
| Sumatra ... ... ... ... ... | 1,130 | 5,449 | 966 | 1,330 |
| Other Eastern Ports ... ... ... | 2,902 | 9,482 | 6,835 | 7,574 |
| Total ... ... ... | 197,436 | 421,964 | 217,346 | 314,262 |

These figures by no means bear out the contention of the mine proprietors, for, although the export for 1891 was less than that of 1889 to these ports, it showed a great improvement upon that of 1890, and largely exceeds that of 1888. But if the trade with eastern ports has not fallen off to so great an extent as has been alleged, it certainly has not increased in so great a ratio as the trade in other directions.

The total quantity of coal exported in 1891 was 2,514,368 tons, so that there remained 1,523,561 tons for the Colony's own consumption, and for the use of steamers as bunker coal. The trade with the other colonies for the last four years is shown in the following table :—

Export of Coal to the other Colonies.

| Colony. | 1888. | 1889. | 1890. | 1891. |
|---|---|---|---|---|
| | Tons. | Tons. | Tons. | Tons. |
| Victoria ... ... ... ... ... | 744,425 | 857,578 | 778,803 | 954,277 |
| Queensland ... ... ... ... | 7,276 | 7,311 | 6,253 | 14,246 |
| South Australia ... ... ... | 94,886 | 190,412 | 131,205 | 264,125 |
| Western Australia ... ... ... | 12,296 | 15,180 | 15,302 | 35,919 |
| Tasmania ... ... ... ... | 39,999 | 65,251 | 56,863 | 73,488 |
| New Zealand ... ... ... ... | 140,882 | 160,637 | 161,118 | 168,921 |
| Total ... ... ... | 1,039,764 | 1,296,369 | 1,149,544 | 1,510,976 |

It will thus be seen that the coal trade of New South Wales with the other Colonies has increased, the figures for 1891 being higher than even those of 1889, which was so far the best on record by 214,607 tons, and an improvement is shown by each of the Colonies individually. Victoria, which has long been the Colony's best customer for coal, took last year 96,699 tons more than in 1889. South Australia, another good customer, took 73,713 tons more in 1891 than in 1889, while both Tasmania and New Zealand show a fair increase. Looking now at the exports of coal to the American Continent and to Oceana, the following results will be perceived :—

Export of Coal to America and Oceana.

| Country. | 1888. | 1889. | 1890. | 1891. |
|---|---|---|---|---|
| | Tons. | Tons. | Tons. | Tons. |
| United States ... ... ... ... | 495,300 | 407,601 | 182,692 | 365,623 |
| Peru ... ... ... ... ... | 9,921 | 25,263 | 24,272 | 24,835 |
| Chili ... ... ... ... ... | 119,505 | 153,183 | 173,906 | 196,186 |
| Mexico ... ... ... ... ... | 2,193 | 10,025 | 5,564 | 12,402 |
| Equador... ... ... ... ... | 1,039 | ..... ... | ..... ..... | 679 |
| Canada ... ... ... ... ... | 4,413 | ..... | ..... | ..... |
| Bolivia ... ... ... ... ... | 1,351 | ..... ..... | ..... | ..... |
| South Sea Islands ... ... ... | 5,786 | 7,369 | 9,126 | 1,569 |
| New Caledonia ... ... ... ... | 11,816 | 14,428 | 10,061 | 23,032 |
| Fiji ... .. ... ... ... | 8,941 | 13,859 | 10,636 | 16,846 |
| Sandwich Islands ... ... .. | 23,124 | 28,096 | 26,509 | 34,789 |
| New Britain ... ... ... ... | ..... | ..... | 920 | 830 |
| Tahiti ... ... ... ... ... | ..... | ..... | 380 | 377 |
| Total ... ... ... | 683,389 | 659,824 | 444,066 | 677,168 |

The total for 1891, it will be seen, is less than that of 1888, but larger than that of 1889. The largest falling off is in the case of ths United States, where, it is said, a large importation of Japanese coal has taken place. The other continental American countries show an increase, and the trade with Oceana generally exhibits an improvement.

The total quantity of British coal taken by countries within the regions in which New South Wales might hope to compete with Great Britain, that is to say, the Pacific seaboard of America and the East Indies, amounts to not more than 800,000 tons, of which quantity some 200,000 tons represents the consumption of ships of war, for which, in all probability, the best Welsh coal would be taken in preference to that of this Colony. This would leave some 600,000 tons to be competed for. If it were possible for New South Wales to secure the whole of this trade, it would mean constant employment for some 1,400 men, or would extend the present average of seven days a fortnight to nearly eight days. Unfortunately, it is hardly possible to look forward to the whole of this trade, inasmuch as there would not be sufficient freight from the countries referred to to warrant vessels entering into the coal trade with Australia, whereas there is almost a certainty of obtaining back freight to Great Britain. Under the most favourable circumstances it could not be expected that New South Wales would secure more than half the quantity or (say) 300,000 tons, which would not increase the work of the Hunter River miners by quite half a day in the week. It would seem, therefore, that an expansion of the coal trade of the Colony must be looked for principally in the direction of the Australasian Colonies and Oceana.

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The effects of the strikes have, perhaps, been more severely felt in the northern than in the southern and western districts, and the Port of Newcastle in particular has suffered. For some time after the termination of the strike of 1890 the coal business was fairly busy, owing to there being a good number of vessels in port, while the collieries had large orders on hand which the strike had prevented them from fulfilling. When, however, the orders on hand were all supplied, the trade became very slack, as it has continued to be, more or less, ever since. It was, doubtless, with the hope of improving this state of things that the proprietors of the Associated Collieries, at the commencement of 1892, agreed to reduce the price of coal from 11s. to 10s. per ton, at the same time lowering the hewing rate to the miners, as per agreement with them, from 4s. 2d. to 3s. 10d. per ton. The six months that have since elapsed is too short a period, perhaps, to show what the effect of this policy will be, but the opinion of the miners about it is very pronounced. They do not hesitate to say in plain terms that it was a foolish proceeding, which has not caused the owners to sell a single extra ton of coal, while it has deprived the miners of 4d. per ton for every ton they have hewed since the beginning of the year. They further assert that the object of the proprietors was not so much to increase the trade of the Colony as to compete with the southern collieries, which are at considerably less expense in procuring the coal, and are therefore enabled to undersell the northern mines. It is certain that they would have to sell over 900,000 tons of coal extra at 10s. per ton in order to recoup themselves for the reduction from 11s. per ton, and assuming that the foreign trade was expanded to the full extent possible, which, as indicated above, would be 300,000 tons, there would remain 600,000 tons to be absorbed by Australasia. The probability of the local and other Australasian markets being induced to use any large additional quantity of coal by reason of the reduction in the selling price from 11s. to 10s. per ton is very remote, and taking all the circumstances into consideration, it must be held that this reduction has been made rather with the view to meet local opposition than to secure an addition to the output of the Colony.

There is no doubt that the demand for southern coal has very much increased of late years. There was formerly a prejudice against it on the ground that it was unfit for steam purposes, and at one time steamships refused to take southern coal on that account; but when the strike at the northern collieries occurred in 1888, and steamship-owners could not procure northern coal, they were compelled to fall back upon the southern article, and it was soon found that, by altering the furnace fire-bars so as to increase the draught, the Illawarra coal answered equally well with the Hunter River coal. The southern mines have the advantage of being within an easy distance of the metropolis, the haulage from Wollongong being 4s. 6d. per ton as against 8s. 6d. from Newcastle. Many of the southern mines have the advantage of possessing jetties of their own from which they can, except in very boisterous weather, place the coal in steam colliers which take but a short time to run up to Sydney, where they go alongside of the large mail boats and fill their bunkers at the minimum of trouble and expense. Further, it is projected to make such harbour improvements along the Illawarra coast that even the largest steamers will be able to lie alongside the wharves and load with perfect safety, and, although it will probably be many years before this is done, it is a possibility which the Northern mine-owners feel that they have to face.

The competition of the western mines against the southern and northern collieries is not very considerable, owing mainly to their distance from Sydney. The nearest of these mines is at Katoomba, which is nearly 70 miles from the metropolis, while those at Lithgow are nearly 100 miles away. They have no means of sending their coal to Sydney except by railway, and the freight—1d. per ton per mile—though little more than will pay bare expenses to the Railway Department, is almost prohibitory, especially in competition with the Illawarra mines, which are so much closer to Sydney. The chief complaint of the mine-owners in the west is that they are thus handicapped by the freights; another grievance they have is that at times, especially during the wool season, the railway authorities do not furnish them with trucks, so that they cannot supply their customers; but it is admitted that there is now much less to complain of in this direction than there used to be in former years.

The assertion is sometimes made by the miners of the Hunter River district that much more coal could be sold in foreign ports if there were ships to carry it away, and it has been advocated that the collieries should unite and build a fleet of steam colliers, so constructed as to be able to carry water ballast. It is proposed that these vessels should simply load with coal, and be independent of return cargoes, and that, in fact, directly the coal is unshipped in a foreign port the vessel should take in her water-ballast and return to Newcastle, where the water would be quickly ejected, and the vessel would be ready to load with coal again. While some of the owners and managers somewhat approve of such a scheme, the majority of them look upon it with disfavour, as it would, they think, take them out of their proper function, which is simply to procure the coal, and would impose upon them the burden of finding purchasers for it abroad. They admit that it would be a good thing if they could have a steady stream of vessels always coming in to be loaded, but they are of opinion that the evil that is now prevalent of having more vessels in the harbour one day than can possibly be supplied, and none at all to load the next day, could not be prevented by the proposed plan, as these vessels would be to a great extent at the mercy of the weather, just as other steamers are. One of the main objections that the proprietors have to the scheme is, however, that it would be placing themselves entirely in the power of the men, for the only way to make the fleet pay would be to load the vessels off as fast as they came in; and if several of the boats were waiting at the same time, the men would be in a position to enforce almost any demand they might choose to make.

The present proposal for the formation of a Coal Trust among the Hunter River collieries stands upon a very different footing. The object seems to be to form a union among the principal mines of the district, so as to reduce the expenses of management, clerical expenses, and so on. It is expected by these means, and by pushing the foreign trade, that the industry may be made more profitable to those who have invested their money in it, and provide more work for the miners. But it has already been shown that the utmost limit to which the foreign trade can be expanded would be some 300,000 tons per annum; and it would probably take some time before even that amount of trade could be secured. The men, however, seem very much opposed to the proposal, for they say that if a miner got discharged from any mine connected with the Trust, no other mine over which the Trust had any control would employ him, so that he would be practically boycotted, and would be compelled to leave the district.

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With regard to the important question as to how far the colliery industry is profitable to those whose capital has been invested in it, it has been found impossible to arrive at an exact conclusion. The mine-owners naturally decline to state what their profits are; but they are tolerably unanimous in affirming that the returns are, and have been for some time past, very unsatisfactory. The only matter upon which we have accurate data upon which to found an opinion as to the cost of the coal is the hewing rate, which, as already shown, was during 1891 in the northern district 4s. 2d. per ton, and in the southern and western districts 2s. 4d. per ton. At these rates, and making allowance for the slack or small coal, for which the miners receive only a few pence per skip, the miners of the northern district would have received in 1891 the sum of £442,208 for hewing the coal; in the western and southern districts £138,212 would have been paid for hewing, and the allowance for yardage paid in cases where the seam was under the standard thickness, or the bord or working was less than the regulation width, would amount probably to about £36,632, so that the sum actually paid to the 7,074 miners of the Colony during the year would have been £617,052. The other labourers employed in and about the mines, to the number of 3,346, men and boys, at an average rate of 7s. 6d. per day, would have each earned about £86 during the year, or £287,756 in all. This would make a total of £904,808 for wages all told. Other expenses, which would include the salaries of the managerial and clerical staffs, rent of offices, rent of mineral leases, royalties, cost of renewals to plant, would come to (say) £244,238, leaving £403,793 as profit and interest on capital invested, and making a total of £1,552,839, the net price received for the coal. These figures refer only to the year 1891, but the profits for the current year will be very considerably less. It should be remarked that the price actually received by the companies for the coal is often considerably below the nominal price. Thus in the northern district in 1891 the nominal price of coal was 11s. per ton, and the hewing rate was paid upon that assumption, whereas in point of fact the sum received by the mine-owners of that district during the year, for their coal only averaged a little under 9s. 6d. per ton. This was due to the existence of a custom in the trade to grant discounts upon the quoted price, and in the keenness of competition these discounts, as will be seen, have run as high as 1s. 6d in 11s., or nearly 14 per cent. A similar system prevails in the other coal districts, so that the actual price received for the coal produced by the western mines was only 4s. 3¼d. per ton and for the southern coal, 7s. 4¾d. per ton, or an average of 8s. 7½d. taking the output of the Colony all through.

As regards the future of the industry there is no apparent reason for apprehension. It is true that every ton of coal taken out of a mine diminishes the worth of the mine by the value of that ton of coal, and in fact decreases the wealth of the Colony unless the money received for that coal is turned to profitable account. But the quantity of coal that has been raised bears so small a proportion to the enormous deposits which are known to exist under a large portion of the surface of the Colony, that there will be room for continued expansion for very many years to come. The trade has a natural tendency to increase, since the demand for coal, in connection with industrial pursuits, is every where extending even at a faster rate than the population, but it would be idle to expect any phenomenal increase in the output, as the Australasian market must always be the mainstay of the trade.

## The Kerosene Shale Industry.

The substance commonly known as kerosene shale, or boghead mineral, first became an article of commercial value in New South Wales about the year 1865, when the quantity produced in the Colony amounted to 570 tons, which was valued at £2,350, or about £4 2s. 6d. per ton, by far the highest price this product has been known to attain. During the period that has elapsed since the date mentioned, the total quantity produced in the Colony has increased to 653,041 tons, valued at £1,416,712, or an average of £2 3s. 5d. per ton. The price of this mineral has fluctuated very considerably; in 1867 it averaged £3 14s. 9d. per ton, while ie 1881 it had fallen as low as £1 9s. 3d. The largest output for any one year was in 1890, when 56,010 tons were raised; in 1891 the quantity produced was only 40,349 tons, but the average price for that year was £1 18s. 9d. per ton, as against £1 17s. 2d. in the previous year.

Although kerosene shale is found in various parts of the country there are only three places where it is worked to any extent; these are Katoomba, Hartley Vale, and Joadja Creek. The methods employed in winning this mineral are similar to those used in mining for coal, with such modifications as are rendered necessary through the varying thickness of the seams. The prices paid for hewing naturally differ very much, but have been arranged so that the miners may average a wage of about 10s. per day, a higher price being paid to the man who works a narrow seam in order to enable him to earn as much money as those who are more favourably situated; in some cases a seam of shale only 9 inches in thickness has been worked, while in other parts it may run to a thickness of 5 or 6 feet. There is great variation also in the quality of the shale; the best is used for mixing with ordinary coal in making gas; the remainder is mostly utilised in the manufacture of kerosene oil.

The plant and appliances used by the colonial companies in this industry are very elaborate and complete. The shale is first retorted, that is, it is placed in retorts holding each about 25 cwt., and then subjected to the action of heat. It may here be remarked that ordinary coal, of very good quality, is usually found in association with the shale, and the companies that work the shale also mine for the ordinary coal. The retorts are filled about twice a week, and the effect of the heat is to drive out the crude and impure oil in a thick treacle-like liquid, very uninviting both in appearance and odour. Many of the lighter products pass off in the state of gas, which can be collected and utilised, burning with a steady bright flame. The crude oil is drawn off into tanks, whence it passes into stills where the remaining volatile and over inflammable liquids are extracted. The purification of the oil is the next step, and for this purpose it is pumped into a series of large vertical boilers, in which it is heated and agitated with certain chemicals, which still further denude it of the dangerous elements, and, in fact, leave it in the state of a pure kerosene oil, which is said to be safer and to give a better light than most of the imported oil. Many of the by-products of the kerosene are highly valuable. For instance, an excellent lubricant is produced, which is in great demand for machinery, and by means of hydraulic pressure a clear alabaster-like wax is obtained which is used for the manufacture of candles.

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